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BOARD OF EDITORS { Mr. Horace E. Smith, Chief Clerk of Weather Bureau, Professors Henry A. Hazen, Thomas Russell, and Charles F. Marvin, and Mr. Edward B. Garriott, in charge of Review Room.

INTRODUCTION.

This REVIEW is based on reports for December, 1892, from 2,893 regular and voluntary observers. These reports are classified as follows: 162 reports from Weather Bureau stations; 44 reports from United States Army post surgeons; 1,984 monthly reports from state weather service and voluntary observers; 219 reports through the Central Pacific Railway Company; 455 marine reports through the co-operation of the Hydrographic Office, Navy Department; 29 reports from Canadian stations; marine reports through the "New York Herald Weather Service"; monthly reports from local services established in all states and territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

CHARACTERISTICS OF THE WEATHER FOR DECEMBER, 1892.

The month was colder than usual, except along the South Carolina, Georgia, and Florida coasts, where the normal temperature obtained. Over large areas in the central and northwestern districts and the plateau regions the mean temperature was 5° to 7° below the December average.

The severest cold wave of the month overspread the Southern States from the 26th to the 29th. At Corpus Christi, Tex., ice three-fourths inch in thickness formed, and heavy frost killed vegetation. In Louisiana orange trees in southern parishes were slightly nipped. In Florida the line of freezing weather was carried to the vicinity of Titusville on the 29th. The timely warning issued by the Weather Bureau of the approach of this cold wave prompted precautionary measures against damage by cold and frost in interior and northern districts of Florida.

PRECIPITATION.

The monthly precipitation was deficient, except from the Southwestern States over the Rocky Mountain and plateau regions and in the central valleys of California. The greatest excess in precipitation occurred in western Tennessee, Arkansas, and east-central Texas, where the monthly amount was 7 to 8 inches greater than the December average. The most marked deficiency was noted in New England and the interior of the south Atlantic states, where the monthly precipitation was 2 to 3 inches less than the normal amount.

The greatest depth of snowfall reported was 201 inches at Pikes Peak, Colo. At Olympia, Wash., 52 inches fell, and the monthly snowfall was 40 to 50 inches at points in northern Upper Michigan, central New York, and western Oregon. Heavy rain from the 1st to the 3d flooded streams in California. From the 20th to the 23d a heavy snowstorm prevailed over the north Pacific coast states. Snow fell to a depth of one to two feet over western Washington and northwestern Oregon, blockading railroads. Heavy rain from the 21st to the 25th caused destructive floods in the Sacramento and San Joaquin valleys, California. The cold wave of the 26th to 29th over the Southeastern States was attended by an exceptionally heavy fall of snow. At Norfolk, Va., the total depth of snow, 19 inches, was reported the greatest fall at that place since 1857, and at points in northern Florida the snow was reported the first that had fallen since 1857.

STORMS.

Exceptionally severe gales prevailed over California from the 1st to the 3d. From 11 a. m. to 5.30 p. m. of the 6th a group of tornadoes visited northeastern Texas. About 11 p. m. of that date a tornado was reported at Paragould, Ark. Destructive gales prevailed over California, Oregon, and Washington from the 20th to the 24th.

CLOSING OF NAVIGATION.

Navigation was closed by ice at all ports on the Great Lakes, and in the rivers of the Middle and Northern States.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for December, 1892, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on Chart II by isobars.

In December the atmospheric pressure is usually highest over the middle plateau region and in an area covering eastern Tennessee and adjoining parts of the Carolinas and Georgia, where it is above 30.20, and is lowest over the Gulf of Saint Lawrence, where it is below 29.95. From the extreme northeastern and northwestern parts of the country the barometric gradient is marked to the Iceland and Bering Sea areas of low pressure, where the normal values are below 29.50 and 29.60, respectively. The pressure increases over the United States, except from the middle plateau region to the north Pacific coast, the most marked increase being shown in the Red River of the North Valley, where it exceeds .05.

In December, 1892, the mean pressure was highest over the middle plateau region, where it was above 30.25, the highest mean reading, 30.30, being noted at Idaho Falls, Idaho. From the middle and northern plateau regions to the middle

Missouri river the mean pressure was above 30.20, and from the Rocky Mountain and plateau regions, over the Ohio Valley, and in the north part of the Gulf States it was above 30.15. The mean pressure was lowest over the Gulf of Saint Lawrence, where it was below 29.75, and the mean readings were below 29.90 over eastern Maine and the Canadian Maritime Provinces.

A comparison of the pressure chart for December, 1892, with that of the preceding month shows an increase of pressure, except over the Gulf and south Atlantic states, New England, and the Saint Lawrence Valley. The greatest increase of pressure occurred over the northern Rocky Mountain region, where it exceeded .20, and the increase was more than .10 from the Dakotas and Nebraska to the middle and north Pacific coast states. The most marked decrease of pressure was noted over Nova Scotia, where it was .20 to .25; at points on the middle Gulf and south Atlantic coasts the decrease was .05.

The mean pressure was generally above the normal, except in the Southern, Southwestern, and Atlantic coast states. The greatest departure above the normal pressure was reported over Washington, where it was .10 to .18; the departure above the normal pressure exceeded .05 over the northern Rocky Mountain and plateau regions and in an area extending from the extreme upper Mississippi valley over Lower Michigan. The most marked departure below the normal pressure was noted over the Canadian Maritime Provinces, where it was .10 to .15, and the departure below the normal was more than .05 over the interior of the middle Gulf states.

HIGH AND LOW AREAS.

The tracks of areas of high and low barometric pressure for December, 1892, are plotted on Charts IV and I, respectively, and some of the more prominent features of the areas are shown in the table at the end of this chapter.

HIGH AREAS.

Six high areas appeared, the average number traced for December during the last 18 years being 8.2. All of the high areas traced for the current month advanced southeastward from the northern Rocky Mountain region and reached the middle or south Atlantic coasts. The average rate of advance of the high areas, 28 statute miles per hour, corresponded with the average velocity of high areas for December of preceding years.

I.—Was a continuation of high area X for November, 1892, and at the opening of the month occupied the western lake region and the upper Ohio valley, with pressure above 30.30. This high area moved southeastward and disappeared off the coast by the night of the 2d.

II.—Appeared north of Montana the evening of the 1st, with pressure 30.20. On that date the temperature fell more than 20° in Utah and southern Idaho, and was below zero north of Montana. During the 2d the high area moved slowly eastward, the temperature fell 20° to 30° from Wyoming to Minnesota, and the morning minimum at Medicine Hat, N. W. T., was —18°. During the 3d this high area advanced to Manitoba, the temperature fell 10° to 20° from Lake Superior to Texas, and a reading of —12° was noted at Winnipeg, Man. Moving eastward to Lake Superior by the evening of the 4th the high area passed thence southeastward off the North Carolina coast by the morning of the 6th, its passage being unattended by marked temperature changes over the eastern part of the country.

III.—Apparently advanced from the region north of Washington, and the morning of the 8th occupied the northern plateau, with pressure above 30.50. On that date the temperature fell more than 20° in the middle Saskatchewan valley. During the 9th this high area advanced to Utah. The morning report of the 9th showed a fall in temperature of 40° to 50° in northwestern North Dakota, and a minimum temperature of —20° at Bismarck, N. Dak. By the evening of that date a fall in temperature of 20° to 26° occurred over South Dakota.

During the 10th the high area advanced to the middle Mississippi valley, the cold wave overspread the Ohio and upper Mississippi valleys, and the line of freezing temperature reached northern Arkansas. During the 11th the high area advanced to West Virginia with pressure above 30.60, and by the night of the 12th had passed off the middle Atlantic coast. On the 11th a slight fall in temperature occurred in the middle Atlantic and New England states, and the morning of the 12th freezing weather was reported in northern South Carolina.

IV.—From the 12th to the 18th the pressure continued high over the north Pacific coast states. On the 18th the temperature fell 20° to 30° over North Dakota and Manitoba. By the morning of the 19th the pressure had risen to 30.60 over Alberta, the temperature had fallen 20° to 40° over the Dakotas and Minnesota, and a reading of —16° was noted at Saint Vincent, Minn. By the evening of the 19th the high area had moved southeastward, the temperature had fallen 20° to 30° over Iowa and northern Missouri, and a reading of —2° was reported at Des Moines, Iowa.

During the 20th the high area advanced to the lower Ohio valley. The morning report of that date showed a fall in temperature of 20° to 30° in the middle and upper Mississippi valleys, and by the evening report the cold wave had reached the Atlantic coast, with a fall in temperature of 20° to 30° in the middle Gulf states and over northwestern New England. During the 21st the high area passed off the Virginia coast, and the morning report showed freezing weather in the north part of the Gulf States.

V and V*a*.—High pressure continued in the Northwest, following the passage of high area IV. On the 20th the temperature fell 20° to 30° from the middle plateau region over the western Saskatchewan valley. The morning of the 21st the pressure was above 31.00 over Alberta, the temperature had fallen 20° to 26° over Nebraska, where the minimum was —8° to —10°, and a reading of —26° was reported at Swift Current, N. W. T. By the evening report of the 21st the pressure had risen to 31.10 at Swift Current, the temperature had fallen 20° to 30° over Montana and the Saskatchewan Valley, a reading of —30° was noted at Swift Current, and the temperature was below zero in South Dakota. During the 22d the high area moved rapidly southeastward to the lower Ohio valley, the temperature fell 20° in the Red River of the North Valley, and a reading of —24° was reported at Moorhead, Minn. The cold wave attending this high area was not severely felt in the Atlantic coast states.

VI and VI*a*.—Appeared north of Washington the evening of the 24th, with pressure above 30.60. During the 25th the high area moved slowly eastward north of Montana, and a cold wave extended over Iowa and Missouri, with temperature —32° at Saint Vincent, Minn., and zero to northern Missouri. During the 26th this high area divided, one part passing rapidly southeastward to Oklahoma, and the other advancing eastward over the Red River of the North Valley. On that date the cold wave overspread the middle and west Gulf states, where the temperature fell 20° to 40°, the temperature fell to zero in northern Arkansas, and freezing weather was reported to the Gulf coast.

During the 27th the high area which had moved southeastward disappeared by a decrease of pressure over the Southwest. The high area from the Red River of the North Valley passed southward to Iowa. On that date the temperature fell 20° to 30° in the middle and east Gulf and south Atlantic states, and the line of freezing weather reached northern

Florida. On the 28th the high area reached the lower Mississippi valley, and moving thence slowly eastward passed off the North Carolina coast during the 31st.

LOW AREAS.

The low areas of December advance eastward at an average velocity of 36 statute miles per hour. West of the 100th meridian they usually follow two principal tracks, one from the Pacific coast north of the 50th parallel south of east to the upper lake region, and the other from Vancouver Island southeastward over the middle plateau and Rocky Mountain regions to the lower Missouri valley. Less frequented tracks are traced from the west part of the Gulf of Mexico to the middle Mississippi valley, and along the Atlantic coast line from the Carolinas to the Canadian Maritime Provinces. East of the 100th meridian the low areas generally move toward the Saint Lawrence Valley, where an average of more than five per month are traced, making this the region of greatest storm frequency within the region of observation. An average of one storm per month traverses the North American continent from the Pacific to the Atlantic coasts in December.

The tracks of 11 areas of low pressure are plotted on Chart I for December, 1892, the average number traced for the corresponding month for the last 18 years being 13. Of the low areas traced for the current month 4 advanced from the north Pacific coast, one is traced eastward from the south Pacific coast, 2 first appeared in the Saskatchewan Valley, 2 moved northeastward from the west Gulf coast, and 2 apparently originated on the southeast slope of the Rocky Mountains.

Of the low areas traced from the north Pacific coast 3 reached the Atlantic coast, and one occupied the lower Mississippi valley at the close of the month. The low area from the south Pacific advanced to the Lake region where it disappeared by an increase of pressure. One of the low areas from the Saskatchewan Valley passed eastward over the Gulf of Saint Lawrence, the other dissipated over the Lake region. The low areas from the west Gulf disappeared off the south Atlantic coast, and those from the Southwest passed eastward over or north of the Gulf of Saint Lawrence.

The low areas from the Northwest generally moved southeastward to the central valleys and thence northeastward to the Saint Lawrence Valley. The average rate of advance of low areas, 35 miles per hour, about corresponded with the average velocity of low areas traced for December of preceding years. The following is a description of the low areas referred to:

I.—Was apparently an offshoot of the severe storm which occupied the north Pacific coast the last seven days of November, 1892. At the opening of the month this low area was central over Montana, with pressure below 29.70. During the 1st the center advanced to North Dakota, the temperature rose 10° to 20° in the Northwest, and snow fell in Montana. On the 2d the low area advanced to Lake Superior, a marked rise in temperature occurred in eastern Ontario, and rain or snow fell in the Lake region. By the morning of the 3d the center had passed southeastward to eastern Ontario, where it united with low area I*a*, which had advanced from the Southwest.

I*a*.—Apparently developed on the southeast slope of the Rocky Mountains. The morning of the 2d the low area was central near Fort Smith, Ark., from which point it advanced to Ohio by the evening report, with a marked rise in temperature in the middle Ohio valley, and rain in the middle Mississippi and lower Ohio valleys and Tennessee. During the 3d the center passed rapidly north of east over the Gulf of Saint Lawrence, the temperature rose 10° to 20° in the south Atlantic states, and rain fell from the Lake region to the east Gulf states.

II.—Occupied the north Pacific coast from the opening of the month until the morning of the 3d. During that period high winds and heavy rain prevailed in California. Oranges were injured by wind, and heavy rain caused floods throughout the greater part of the state. By the evening of the 3d the center had advanced to western Montana, the temperature had risen 20° to 40° on the northeast slope of the Rocky Mountains, and the rain area had extended from the Pacific coast over Montana.

On the 4th the center advanced to South Dakota, the temperature rose 20° to 30° in the Red River of the North Valley, and rain or snow fell in areas on the northeast slope of the Rocky Mountains. During the 5th the center advanced to the lower Missouri valley, a marked rise in temperature occurred from the Lake region to the east Gulf coast, rain fell in the middle Mississippi valley, rain or snow was reported from Nebraska over the Lake region, and heavy snow fell at Salt Lake City, Utah.

By the evening of the 6th the center had advanced to the Saint Lawrence Valley, with a marked rise in temperature in the middle Atlantic and New England states, and rain or snow had fallen generally in the Lake region, middle Mississippi and Ohio valleys, and thence over the middle Atlantic and New England states.

III.—Appeared over the interior of Texas the morning of the 6th, and by the evening report had advanced to Missouri with pressure below 29.70. On that date rain or snow fell generally in the Western and Southwestern States. In central Kansas and eastern Nebraska exceptionally heavy snow interrupted railroad traffic. Destructive tornadoes were reported in Arkansas and Texas.

During the 7th the center advanced to southern Lake Michigan with a marked increase in energy, the temperature rose 10° to 20° in the Lake Erie region, the wind reached a velocity of 50 miles an hour from the southwest at Chicago, Ill., rain or snow was general from the Lake region to the Gulf coast, and very heavy snow fell from eastern Kansas and eastern Nebraska over Iowa and northwestern Missouri. Moving northeastward the center disappeared north of the region of observation the night of the 8th. On that date rain or snow fell generally over the north-central and northeastern districts, and westerly gales prevailed over the Lake region.

IV.—Appeared over southern California on the 10th, passed eastward to New Mexico during the 11th, reached southern Texas the morning of the 12th, and the evening of that date was central near Shreveport, La. On the 11th heavy rain set in on the west Gulf coast and the rain area extended over Texas and Oklahoma. On the 12th a marked rise in temperature occurred from the west Gulf states to the Lake region, the rain area extended to the Missouri and Ohio valleys, and a storm of sleet and rain set in over parts of the Southwest.

During the 13th the center advanced to southern Lake Michigan with a marked increase of strength, rain or snow fell from the Lake region to the east Gulf coast and thence to the middle Atlantic coast, the temperature rose 10° to 20° in the Ohio Valley and Tennessee, severe local storms were reported in Louisiana and Mississippi, and high winds prevailed over the Lake region. During the 14th this low area disappeared by an increase of pressure over the Lake region.

V.—Appeared over Alberta and moved slowly eastward over the Saskatchewan Valley on the 12th. On that date the temperature rose 10° to 20° on the northeast slope of the Rocky Mountains, and rain or snow fell in the north Pacific coast states. During the 13th the center advanced slowly southeastward, and on the 14th apparently disappeared by an increase of pressure over the Lake region.

VI.—Appeared near the mouth of the Rio Grande River on the 15th, attended by heavy rain generally in the west Gulf states. During the 16th the center moved northeastward to Mississippi, the temperature rose 10° to 20° over the interior

of the east Gulf states, and rain fell generally from the Ohio Valley to the Gulf coast. During the 17th the center disappeared off the North Carolina coast, and the rain area contracted to the Gulf and Atlantic coasts.

VII.—Appeared over the Saskatchewan Valley on the 17th, with pressure below 29.60. On that date the temperature rose 20° to 40° in the Northwest, and snow was reported in western Montana. During the 18th the center passed southeastward over Lake Superior, a marked rise in temperature occurred from the Lake region over the Southwestern States, and rain or snow fell in the north-central districts. By the evening of the 19th the center had advanced to the lower Saint Lawrence valley, and the rain area had extended over the interior of the Atlantic coast states.

VIII.—Appeared on the west Gulf coast the morning of the 19th and by the evening report had advanced to southern Alabama, with pressure below 29.70. On that date the temperature rose 10° to 16° on the middle Gulf coast, rain fell generally in the Southern and Southwestern States, and southwest to northwest gales prevailed along the middle and west Gulf coasts. By the morning of the 20th the center had moved off the North Carolina coast, with pressure below 29.50. Heavy rain fell generally east of the Mississippi and south of the Ohio rivers, and heavy north to west gales prevailed along the south Atlantic coast.

IX.—From the 21st to the 24th a storm area of great energy covered the middle and north Pacific coast states. During that period the rainfall was unusually heavy in California, exceptionally heavy snow fell in Oregon and Washington, and heavy gales of 50 to 60 miles per hour prevailed along the Pacific coast north of the 35th parallel. During the 24th the storm center apparently moved southeastward over Oregon, the temperature rose more than 20° in Colorado, the rain area extended over the middle and northern plateau regions, and a heavy wind and rain storm prevailed over Oregon and northern California.

Moving rapidly southeastward the center of disturbance reached the west Gulf states the evening of the 25th. On that date a marked rise in temperature occurred in the west Gulf and south Atlantic states, a heavy wind and snow storm set in over Kansas, and rain or snow fell generally in New England, the middle Atlantic states, the Lake region, the central valleys, and along the east Gulf coast.

During the 26th the center advanced to northern Florida, rain changed to snow in the east Gulf states, snow fell to the immediate Gulf coast, and high northeast winds with rain changing at night to sleet and snow set in over the south Atlantic states. During the 27th this low area passed northeastward off the south Atlantic coast. Heavy snow fell in the south Atlantic states, and high north to northwest winds prevailed on the Carolina coast.

X.—Appeared north of Washington on the 28th, with pressure below 29.60. On the 27th the temperature rose 20° to 30° on the northeast slope of the Rocky Mountains, and rain fell in the north Pacific coast states. On the 28th the temperature rose more than 20° over the eastern Saskatchewan valley, the rain area extended over the middle and northern plateau regions, and south to west gales of 60 to 66 miles per hour prevailed on the Washington coast. Moving rapidly southeastward the center reached Colorado the evening of the 29th. On that date a marked rise in temperature occurred in the central valleys, and snow fell generally over the Missouri Valley and the middle plateau region.

During the 30th the center advanced to southern Texas, the rain area extended from the middle Mississippi valley to New Mexico, and northwest gales prevailed over the southern plateau and southern Rocky Mountain regions. At the close of the month this low area occupied the lower Mississippi valley, with pressure below 29.50. On that date the rain area extended over the Gulf States and the Ohio Valley, a heavy thunderstorm was reported at Mobile, Ala., and high southwest to northwest winds prevailed along the middle and west Gulf coasts.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.			Last observed.		Duration.	Velocity per hour.	Maximum pressure change in 12 hours, maximum abnormal temperature change in 12 hours, and maximum wind velocity.								
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.			Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date.
High areas.		°	°	°	°	*Days.*	*Miles.*		*Inch.*			°					
I	1	42	85	40	81	1.0	10	Halifax, N. S.	.14	1	Knoxville, Tenn.	10	1	Hatteras, N. C	n.	20	2
II	1	52	113	36	75	4.5	22	Salt Lake City, Utah	.44	1	Pueblo, Colo.	23	1	Chicago, Ill	ne.	20	4
III	8	45	115	38	76	4.5	23	Grand Haven, Mich.	.48	8	Fort Buford, N. Dak	29	8	Havre, Mont	ne.	34	8
IV	19	52	114	37	77	2.0	50	Hatteras, N. C	.70	20	Huron, S. Dak	29	18	Amarillo, Tex.	n.	34	19
V	21	52	112	34	88	2.0	37	Swift Current, N. W. T.	.70	21	Swift Current, N. W. T.	26	21	Key West, Fla	n.	18	23
V*a*	22	51	104	33	81	3.0	26	do	.70	21	St. Vincent, Minn.	11	22	do	n.	22	24
VI	24	53	118	40	97	2.0	31	Fort Smith, Ark.	.54	26	Palestine, Tex.	34	26	Amarillo, Tex	n.	48	26
VI*a*	26	52	103	32	76	5.0	23	Calgary, N. W. T	.32	27	Green Bay, Wis	13	27	Hatteras, N. C	n.	18	29
Mean						3.0	28		.50			22				27	
Low areas.									Fall.			Rise.					
I	1	45	109	45	77	2.0	35	Winnipeg, Man	.34	1	Cincinnati, Ohio	20	3	Lander, Wyo	sw.	48	1
I*a*	1	37	98	45	77	1.5	36	Columbus, Ohio	.24	2	do	20	3	Cleveland, Ohio	nw.	36	2
II	3	48	125	45	73	3.5	35	Albany, N. Y.	.38	6	Qu'Appelle, N. W. T	24	3	Fort Canby, Wash	s.	66	1
III	6	32	100	48	80	2.5	26	Saugeen, Ont	.54	7	Erie, Pa	20	7	Chicago, Ill	sw.	50	7
IV	10	32	115	44	81	3.5	30	Detroit, Mich.	.46	13	San Antonio, Tex	27	12	Buffalo, N. Y	sw.	48	14
V	12	53	114	52	100	1.5	18	Medicine Hat, N. W. T.	.34	12	Havre, Mont	30	12	Valentine, Nebr.	nw.	26	13
VI	15	27	98	36	75	1.5	42	Vicksburg, Miss.	.24	16	Mobile, Ala.	11	16	Galveston, Tex.	e.	26	15
VII	17	54	105	49	68	2.5	32	Moorhead, Minn	.64	17	Moorhead, Minn.	32	17	Chicago, Ill	sw.	40	18
VIII	19	30	95	36	74	1.0	54	Hatteras, N. C	.46	20	Galveston, Tex	18	19	Kittyhawk, N. C.	n.	56	20
IX	24	47	124	30	82	2.5	45	Norfolk, Va	.48	25	San Antonio, Tex	19	25	Fort Canby, Wash.	se.	67	24
X	28	51	122	33	91	3.0	37	Meridian, Miss.	.50	31	Pierre, S. Dak	24	29	Tatoosh Island, Wash	w.	66	28
Mean						2.3	35		.42			22				48	

NORTH ATLANTIC STORMS FOR DECEMBER, 1892.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The paths of storms that appeared over the west part of the north Atlantic Ocean during December, 1892, are shown on Chart I. These paths have been determined from reports of observations by shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."